

REMARKS

Upon entry of the Amendment, claims 1-2 and 4-8 are all the claims pending in the application. Claim 1 has been amended. Claim 3 has been canceled without prejudice.

Claim 1 has been amended to recite that the inner portion has a hydrogen concentration of $1 \times 10^{18} \text{ cm}^{-3}$ or more and an impurity concentration of $1 \times 10^{18} \text{ cm}^{-3}$ to $1 \times 10^{21} \text{ cm}^{-3}$, and wherein the top portion has a hydrogen concentration lower than that of the inner portion. Support for the amendment to claim 1 can be found in the specification, for example, on page 4, paragraph 3 and page 7, last paragraph.

No new matter has been added. Reconsideration of the application and allowance of all claims are respectfully requested.

I. Claim Rejections under 35 U.S.C. § 102(b) over Yagi

Claims 1-2 and 4-6 were rejected under 35 U.S.C. § 102(b) as allegedly being anticipated by Yagi et al. (US 6,297,442; "Yagi").

Applicants respectfully traverse this rejection.

Specifically, claim 1 recites a gallium nitride-based semiconductor device having a p-type layer that is a gallium nitride (GaN) compound semiconductor layer, wherein the p-type layer comprises a top portion and an inner portion located under the top portion, and wherein the top portion includes a region containing a Group III element and a Group V element at a non-stoichiometric atomic ratio.

On the other hand, Yagi discloses a solar cell display device having a transparent conductive substrate 20 having thereon a second photoconductor layer 21-b (metallic oxide compound semiconductor), a first photoconductor layer 21-a (Group III-V compound semiconductor) and a transparent electrode 22. Col. 7, lines 1-5; and Figure 5. Yagi also

discloses that the photoconductor layer containing the Group III-V compound semiconductor may comprise an n-type or p-type photoconductor containing at least one element selected from Al, Ga and In, with nitrogen and hydrogen. Col. 7, lines 13-16.

The photoconductor layer 21-b (metallic oxide compound) of Yagi is not a p-doped GaN compound semiconductor layer as required by the present claims. Instead, Yagi discloses that the metallic oxide semiconductor may be, for example, titanium oxide or zinc oxide (col. 5, lines 44-47).

The passage at col. 14, lines 6-8 (Example 3) cited by the Examiner relates to Fig. 2, where p-type GaN:H(Mg) film 23 is deposited on i-type GaN:H(Mg) film 24, which in turn is deposited on n-type GaN:H(Si) film 25. However, there is no disclosure in Example 3 of Yagi of a top portion including a region containing a Group III element and a Group V element at a non-stoichiometric atomic ratio as claimed in present claim 1.

In addition, Claim 1 presently recites that the inner portion has a hydrogen concentration of $1 \times 10^{18} \text{ cm}^{-3}$ or more and an impurity concentration of $1 \times 10^{18} \text{ cm}^{-3}$ to $1 \times 10^{21} \text{ cm}^{-3}$, and wherein the top portion has a hydrogen concentration lower than that of the inner portion.

The Examiner acknowledged that Yagi does not expressly teach the hydrogen or p-type concentration. However, the Examiner took the position that a concentration on the order 10^{18} cm^{-3} to 10^{21} cm^{-3} is well-understood in the art. To support this position, the Examiner cited DiLorenzo (US 3,762,945).

DiLorenzo discloses a technique for the fabrication of a millimeter wave beam lead Schottky barrier device. The technique involves the growth of a 6 to 8 micron layer of epitaxial gallium arsenide doped to a value within the range of $3 \times 10^{18} \text{ atoms/cc}$ to $5 \times 10^{18} \text{ atoms/cc}$ on a

semi-insulating gallium arsenide substrate by the arsenic trichloride-gallium-hydrogen vapor transport technique. Col. 1, lines 54-60.

However, DiLorenzo does not disclose or suggest that the inner portion of the p-type layer has a hydrogen concentration of $1 \times 10^{18} \text{ cm}^{-3}$ or more and an impurity concentration of $1 \times 10^{18} \text{ cm}^{-3}$ to $1 \times 10^{21} \text{ cm}^{-3}$. DiLorenzo does not make up the noted deficiency of Yagi.

Furthermore, the inner portion of the p-type layer as claimed in present claim 1 contains hydrogen, while Yagi does not disclose that the photoconductor layer 21-b contains hydrogen.

In view of above, it is respectfully submitted that Yagi does not anticipate the present claims, and withdrawal of the present rejection of claims 1-2 and 4-6 under 35 U.S.C. § 102(b) is respectfully requested.

II. Claim Rejection under 35 U.S.C. § 103(a) over Yagi in view of Udagawa

Claims 7 and 8 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Yagi et al. in view of Udagawa (JP 2004-14810 A). Applicants respectfully traverse this rejection.

Yagi discloses a solar cell display device having a transparent conductive substrate 20 having thereon a second photoconductor layer 21-b (metallic oxide compound semiconductor), a first photoconductor layer 21-a (Group III-V compound semiconductor) and a transparent electrode 22. Col. 7, lines 1-5; and Figure 5. Yagi discloses that the photoconductor layer containing the Group III-V compound semiconductor may comprise an n-type or p-type photoconductor containing at least one element selected from Al, Ga and In, with nitrogen and hydrogen. Col. 7, lines 13-16.

However, Yagi at least fails to disclose or teach a p-type layer having a top portion and an inner portion, the top portion of the p-type layer includes a region containing a Group III

element and a Group V element at a non-stoichiometric atomic ratio, wherein the inner portion has a hydrogen concentration of $1 \times 10^{18} \text{ cm}^{-3}$ or more and an impurity concentration of $1 \times 10^{18} \text{ cm}^{-3}$ to $1 \times 10^{21} \text{ cm}^{-3}$, and wherein the top portion has a hydrogen concentration lower than that of the inner portion, as recited in independent claim 1.

Applicants rely on the response above with respect to the rejection of claims 1-2 and 4-6 over Yagi alone. Udagawa does not make up for the deficiencies of Yagi. Accordingly, claims 7 and 8 depending from claim 1 are therefore patentable over Yagi in view of Udagawa at least by virtue of their dependency from claim 1.

III. Conclusion

In view of the above, reconsideration and allowance of this application are now believed to be in order, and such actions are hereby solicited. If any points remain in issue which the Examiner feels may be best resolved through a personal or telephone interview, the Examiner is kindly requested to contact the undersigned at the telephone number listed below.

The USPTO is directed and authorized to charge all required fees, except for the Issue Fee and the Publication Fee, to Deposit Account No. 19-4880. Please also credit any overpayments to said Deposit Account.

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